

CRASH RESEARCH & ANALYSIS, INC.

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ON-SITE AMBULANCE CRASH INVESTIGATION

SCI CASE NO: CR12002

VEHICLE: 2011 FORD E350 CHASSIS

AMBULANCE BODY: AEV TYPE II

LOCATION: NEW JERSEY

CRASH DATE: NOVEMBER 2012

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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AMBULANCE BODY: AEV TYPE II

LOCATION: NEW JERSEY

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BACKGROUND

This on-site investigation focused on the crash of a 2011 Ford E350 Type II ambulance (**Figure 1**) and the injury source(s) for the fatally injured 30-year-old male Emergency Medical Technician (EMT) occupying the patient compartment. Notification of the crash was provided to the Crash Research & Analysis (CRA) Special Crash Investigations (SCI) team on November 27, 2012 by the Crash Investigations Division of the National Highway Traffic Safety Administration. The SCI team initiated immediate telephone contact with the ambulance company, the County Prosecutor's Office that was in charge of the investigation and the Investigations Branch of the New Jersey Department of Health (NJDOH). Cooperation to inspect the vehicles was obtained from the NJDOH Investigator on December 3, 2012 and the case was assigned for on-site investigation. The CRA investigator initiated travel to the crash site on the same day. The on-site activities included the inspection and documentation of the vehicles and crash site, the imaging of the ambulance's Event Data Recorder (EDR) and an interview with the supervisor of the ambulance company.



Figure 1: Front right view of the Ford ambulance.

The 2011 Ford E350 ambulance was occupied by a 26-year-old male driver, the EMT and a 58-year-old female patient. The EMT was seated on the rear-facing Captain's seat monitoring the patient's vital signs at the time of the crash. The patient was restrained on a Ferno stretcher by three lateral restraints. The ambulance was traveling through a four-leg intersection at the time of the crash and was struck on its right side by a 2004 Chrysler Pacifica. The force of this crash displaced the ambulance to its left and into contact with a 2004 Workhorse Delivery step van. A county-owned 2012 Ford transit bus then impacted the back plane of the Chrysler. The

ambulance overturned onto its right plane as it traveled to final rest. The initial media reports indicating that the EMT was ejected from the patient compartment during the crash were proven incorrect through the course of the investigation. The EMT was extricated from the patient compartment and transported to a trauma center where he was pronounced deceased due to a head injury.

CRASH SUMMARY

Crash Site

The crash occurred at the four-leg intersection of an east/west road and a north/south road that was located in an urban setting. At the time of the crash, it was daylight, clear and dry. Each road was surfaced in asphalt and the terrain was level. The traffic flow through the intersection was controlled by standard overhead (tri-colored) traffic signals. In the ambulance's eastbound direction of travel, the road consisted of four lanes (two lanes in each direction). A double yellow centerline separated the traffic passing in opposite direction. In the Chrysler's northbound travel direction the road consisted of two lanes that were separated by a double yellow centerline. Concrete curbs and 5 m (16.4 ft) wide sidewalks bordered the roads. The speed limit in the area of the crash for both roads was 40 km/h (25 mph) **Figure 2** is a trajectory view of the ambulance's eastbound approach to the intersection. **Figure 3** is a northbound approach view of the Chrysler.



Figure 2: Eastbound trajectory of the ambulance.



Figure 3: Northbound trajectory of the Chrysler.

Figure 4 is an on-scene image taken by local media coverage which documented the crash. The final rest positions of the vehicles were located on the east leg of the road immediately to the east of the intersection. At the time of the SCI scene inspection, the only residual physical evidence was four short tire marks that were observed on painted lines of the east leg road in the northeast intersection quadrant. The marks measured 0.7 m (2.2 ft) in greatest length and were attributed to the right tires of the Workhorse as it slid to final rest. **Figure 5** is an image of the final rest

locations of the ambulance and Workhorse taken during the SCI inspection. The tire marks attributed to the post-impact movement of the Workhorse are visible in the image.



Figure 4: View of the final rest positions of the vehicles. (Image obtained from an internet news source.)

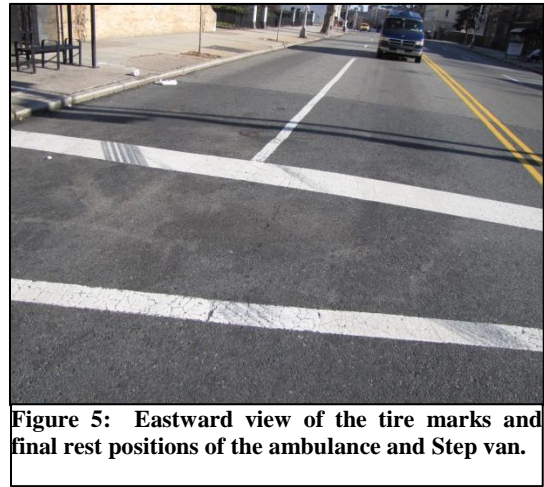


Figure 5: Eastward view of the tire marks and final rest positions of the ambulance and Step van.

Pre-Crash

The ambulance was transporting the 58-year-old female patient to the hospital for an examination after receiving dialysis. The EDR indicated that the Ford's engine was operating for approximately 14 minutes prior to Algorithm Enable (AE). The ambulance was traveling eastbound in left-most lane (closest to the center) in a non-emergency mode. The ambulance's lights and siren were not activated. As the ambulance approached and entered the intersection, the traffic signal was on the green phase for east/west traffic. The data imaged from the vehicle's EDR indicated the speed of the ambulance was 44 km/h (27.3 mph) five seconds prior to AE and had accelerated to 57 km/h (35.4 mph) at AE. The northbound Chrysler was driven by a 26-year-old male. Police-reported data indicated that this vehicle was being pursued by the police for a criminal matter and that it was traveling at an estimated 64 to 80 km/h (40 to 50 mph) as it entered the intersection. The Workhorse was traveling west through the intersection in the left lane (closest to the centerline) at a slow rate of speed driven by a 34-year-old male. The Ford bus was eastbound driven by a 23-year-old male. The bus was in the left lane trailing behind the ambulance an unknown distance. A **Crash Diagram** is included at the end of this technical report on Page 21.

Crash

The front plane of the Chrysler impacted the right plane of the ambulance as both vehicles attempted to traverse the intersection (Event 1). The center of the impact force was located forward and below the ambulance's center of gravity and resulted in a left deflection, a counterclockwise (CCW) rotation, and a right rolling motion of the ambulance. The Chrysler reacted to the force of the crash with a rapid clockwise (CW) rotation and a downward pitching. The rapid CW rotation resulted in a side slap at the forward aspect of the Chrysler's left plane

(Event 2). These impact dynamics and the lateral momentum of the ambulance resulted in a deep end-swiping damage pattern to the Chrysler as the vehicles reached maximum engagement.

The severity (delta-V) of the Event 1 crash was calculated by the WinSMASH program. The total delta-V of the ambulance was 22 km/h (14 mph) with a longitudinal and lateral component of -11 km/h (-7 mph) and -19 km/h (-12 mph). The total delta-V of the Chrysler was 43 km/h (27 mph). These values appeared to be under-estimated based on SCI field experience. For comparison, the EDR-reported maximum longitudinal and lateral delta-V of the ambulance was -24.12 km/h (-14.99 mph) and -41.77 km/h (-25.95 mph).

The left deflection of the ambulance resulted in contact between the left front fender of the ambulance and the forward aspect of the Workhorse's left plane (Event 3). As the impact sequence continued to develop, the front plane of the ambulance then engaged the left plane of the Workhorse due to the CCW rotation of the ambulance. The engagement between the ambulance and Workhorse (backed up by the Chrysler) decelerated and then reversed the direction of the Workhorse. The force of the impact forward of the vehicle's center of gravity caused it to rotate CW, as the Workhorse was redirected to the east.

During this impact sequence, the aft left side of the Chrysler engaged with the right side of the ambulance in a side slap type interaction (Event 4) due to the continued rotation of the vehicles. Additionally, the ambulance continued to rollover to the right. The damage to the back plane of the ambulance occurred through its non-horizontal contact with the aft aspect of the Chrysler's left plane and its roof side rail. The Chrysler and Workhorse began to separate from the ambulance, thus allowing the ambulance to complete the rollover (Event 5).

The eastbound Ford bus entered the intersection during the later stage of the crash sequence. The front plane/right aspect of the bus impacted the back plane of the Chrysler (Event 6). The force of this impact displaced the Chrysler to the east.

The vehicles separated and traveled to their final rest positions. The Workhorse rotated approximately 80 degrees CW and came to rest facing north adjacent to the bus stop on the east leg of the intersection. The tire marks identified during the SCI scene inspection were used to reconstruct post-impact movement. The ambulance completed a right side leading one-quarter turn rollover and came to rest on its right plane, facing north in an orientation parallel to the Workhorse. The Chrysler was displaced forward to its final rest position adjacent to the south curb on the east leg of the intersection. The Ford transit bus came to rest facing east, immediately to the west of the ambulance. The rest positions of the vehicles were documented in **Figure 4** (the on-scene news image) above.

Post-Crash

The police and additional ambulance personnel responded to the scene of the crash. The driver of the ambulance reportedly exited the vehicle through the left front door and climbed down from the left plane of the vehicle. He was transported to a local hospital with a left thumb fracture, right eyebrow contusion and unspecified neck and back pain. The supervisor of the ambulance company indicated he was held overnight for observation and released.

The first responders removed the windshield of the ambulance to access the vehicle's interior and also entered the ambulance through the rear doors. Throughout the crash sequence, the patient remained on the stretcher and the stretcher remained secured to the ambulance. She was removed from the ambulance and was subsequently transported to a trauma center where she was admitted for treatment. The patient sustained a small subdural hematoma and complained of a headache and generalized neck, chest, back and abdominal pain upon admission. Her recovery went smoothly until hospital day six day when she was observed to have an altered mental status. Her condition deteriorated over the next two days and she died from multiple system complications. Her death was ruled disease. It was not attributed to the crash.

The EMT was found on the right side of the overturned ambulance. He had sustained trauma to the head and neck, was removed from the patient compartment and transported to a trauma center which was located 0.8 km (0.5 miles) from the crash scene. He was pronounced deceased upon arrival.

2011 FORD E350 TYPE II AMBULANCE

Description

The 2011 Ford E350 Type II was owned by a private ambulance company that had approximately 12 additional vehicles. The company provided private medical transportation to individuals. It did not provide emergency response.

The ambulance was identified by the Vehicle Identification Number (VIN): 1FDSS3ES9BDxxxxxx and was manufactured as an incomplete vehicle in March 2011. The digital odometer reading was unknown due to a damaged electrical system. The super duty extended van was built on a 351 cm (138 in) wheelbase and was equipped with the Type II ambulance prep package. The rear-wheel drive vehicle had a Gross Vehicle Weight Rating (GVWR) of 4,309 kg (9,500 lb) with a front axle and rear axle rating of 1,905 kg (4,200 lb) and 2,760 kg (6,084 lb), respectively. The power train consisted of a 6.8-liter, V-10 engine linked to a 5-speed automatic transmission. The manufacturer's recommended tire size was LT245/75R16 front and rear, with cold tire pressures of 414 kPa (60 PSI) front and 550 kPa (80 PSI) rear. The left front tire was a Federal Maha Steel 357 tire of the recommended size. The left rear and both right tires were Hankook DynaPro AS tires of the recommended size. Specific measured tire data was as follows:

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	538 kPa (78.0 PSI)	10 mm (13/32 in)	No	No
LR	538 kPa (78.0 PSI)	10 mm (12/32 in)	No	No
RR	538 kPa (78.0 PSI)	10 mm (12/32 in)	No	No
RF	Unknown – valve concealed by damage	10 mm (13/32 in)	Yes	No

The front interior of the Ford was equipped with box-mounted bucket seats with integral head restraints. The driver seat was in a full rear track position. Safety features included 3-point lap and shoulder safety belts with buckle pretensioners for the front occupants. The driver and front right passenger positions were equipped with frontal air bags.

Patient Compartment

The patient compartment of the ambulance was manufactured by American Emergency Vehicles (AEV) of Jefferson, NC in May 2011. The patient compartment consisted of the typical Type II interior layout with a raised fiberglass roof. The layout included: double-rear entry doors for stretcher loading, a three-passenger bench seat along the right side, a rear-facing Captain's seat against the bulkhead immediately forward of the stretcher, double right side entry doors, multiple cabinets for storage and an open pass-through to the occupant compartment of the van.

Exterior Damage

The ambulance sustained direct and induced damage to the right, left, front and back planes as a result of the multiple event crash. The Event 1 direct damage measured 249 cm (98.0 in) and extended along the right plane from a point 74 cm (29.0 in) forward of the right rear axle to a point on the right front wheel rim located 323 cm (127.0 in) forward of the rear axle reference. **Figure 6** is a right oblique view of the damage. The Field L (direct plus induced damage) measured 358 cm (141.0 in) and began 13 cm (5.2 in) forward of the rear axle. The lateral impact crushed the right plane, deformed the right frame member and separated the drive shaft. The right wheelbase was reduced 11 cm (4.2 in) as a result of the frame deformation. The residual crush profile was as follows: C1 = 0, C2 = 14 cm (5.5 in), C3 = 42 cm (16.5 in), C4 = 48 cm (18.9 in), C5 = 24 cm (9.5 in), C6 = 0. The maximum crush was at C4 which was located adjacent to the right B-pillar. This damage pattern extended to a height of 104 cm (41.0 in) above the ground. The total delta-V of the



Figure 6: Right oblique view of the Event 1 impact damage to the ambulance.

ambulance calculated by the Damage algorithm of the WinSMASH program was 22 km/h (14 mph), with longitudinal and lateral components of -11 km/h (-7 mph) and -19 km/h (-12 mph), respectively. These results were considered to be low. The Collision Deformation Classification (CDC) assigned to this damage pattern was 02RYEW4.

The impact damage related to Event 3 was located on the forward left plane (**Figure 7**) and across the front plane of the ambulance (**Figure 8**). The contact damage to the left plane measured 103 cm (40.5 in) in length and was located on the left fender 308 cm to 409 cm (121.5 in to 161.0 in) forward of the left rear axle. The height of the damage measured 97 cm (38 in) above the ground. The damage consisted of sheet metal abrasions and lateral deformation to the fender measuring less than 3 cm (1 in) in greatest depth. Although the contact was located above the left front axle, the wheel assembly did not exhibit damage. The left wheelbase measurement was not changed. This damage pattern appeared to wrap around the left front corner and extend across the front plane. The damaged components included the chrome front bumper, plastic grill, headlamp assemblies, and hood. There was no crush or deformation to the upper radiator support. The face of the front bumper was rotated to a near vertical orientation. The direct contact at the bumper elevation began 66 cm (26 in) left of center and extended 155 cm (61 in) to the front right corner. The residual crush profile was as follows: C1 = 0, C2 = 6 cm (2.5 in), C3 = 18 cm (7.0 in), C4 = 24 cm (9.5 in), C5 = 27 cm (10.5 in), C6 = 33 cm (13.0 in). This CDC was 12FDEW2.

The back plane damage (Event 4) was located at



Figure 7: View of the ambulance's left fender damage.



Figure 8: Front view of the ambulance.



Figure 9: Right rear oblique view of the Event 4 ambulance damage.

the extreme right corner and buckled the right plane forward. This damage pattern (**Figure 9**) was consistent with a non-horizontal impact to the back plane during its contact with the Chrysler. The ambulance was rolled to its right and partially supported by the Chrysler. Black scuff marks were noted to the right side plane of the ambulance from contact with the Chrysler's roof rack. This damage pattern was isolated to the right corner and measured 30 cm x 122 cm (12 in by 48 in), width by height. It was began 86 cm (34 in) above the ground and extended to 208 cm (82 in) above the ground reference. The CDC assigned to this damage pattern was 00BRHE2.

The ambulance rolled over one-quarter turn onto its right side (Event 5). The rollover was initiated by the collision with the Chrysler and then exacerbated by the multiple events with the Workhorse and Ford bus. The impact damage related directly to the rollover was minimal and consisted of body panel abrasions to the right plane. The CDC assigned to the rollover was 00RDAO1.

Event Data Recorder

The Ford was equipped with a Restraints Control Module (RCM) that had EDR capabilities. The EDR data was imaged at the time of the SCI inspection through the use of the Bosch Crash Data Retrieval scan tool and software version 8.0 and reported with version 12.0. The data was imaged via a direct connection to the Diagnostic Link Connector located under the left instrument panel of the van. The vehicle's 12-volt battery was reconnected to supply power. The RCM had the capacity to store two deployment events. Deployment events were locked within the module's memory and could not be overwritten.

The imaged EDR data contained one locked frontal event and one rollover event which were recorded together in a single record, designated the "*First Record*". Analysis of the recorded events was consistent with the circumstances of the intersection crash (Event 1). The data was locked and the recording was complete. The ignition cycles at the time of the crash were 10,302 and 10,305 at the time the data was imaged. The data reported that the Driver Belt was "*Buckled*" and the Air Bag Warning Lamp was "*Off*" at AE. The suppression of the front right air bag was "*Not Active*". The pretensioner actuated 50 milliseconds after AE and the frontal air bags deployed at 544.5 milliseconds. The recorded maximum longitudinal delta-V was -24.12 km/h (-14.99 mph) at 300 milliseconds. The maximum lateral delta-V was -41.77 km/h (-25.95 mph) at 71 milliseconds. The rollover sensor data time zero was 0.24 degrees and rapidly increased to +49.59 degrees at 0.7 seconds. The rollover sensor data then remained constant at +49.59 degrees until 1.8 seconds and then the recording ceased. The positive polarity of the roll angle was consistent with Society of Automotive Engineers (SAE) sign convention and the right side leading rollover of the crash.

The EDR recorded 5 seconds of Pre-Crash vehicle speed, engine RPM, service brake status and accelerator pedal percent. The pre-crash data associated with the First Record is listed in the following table:

Time sec	Speed km/h (mph)	Engine RPM	Accelerator Pedal Percentage	Service Brake Status
-5.0	44.0 (27.3)	2,100	51	Off
-4.5	46.0 (28.6)	2,200	49	Off
-4.0	48.0 (29.8)	2,100	31	Off
-3.5	49.0 (30.4)	2,200	40	Off
-3.0	50.0 (31.1)	2,200	38	Off
-2.5	52.0 (32.3)	2,300	43	Off
-2.0	53.0 (32.9)	2,300	46	Off
-1.5	55.0 (34.2)	2,400	44	Off
-1.0	56.0 (34.8)	2,400	44	Off
-0.5	57.0 (35.4)	2,400	29	Off
0	57.0 (35.4)	2,100	7	Off

Interior Damage - Cab

Inspection of the left front occupant compartment (driver's area) of the ambulance was unremarkable. There was no observed evidence of interior occupant contact points. The absence of contact points was attributed to the driver's use of the available safety systems. The driver seat was jammed in a full-rear track position. The driver seat back angle measured 25 degrees aft of vertical. The two-spoke tilt steering wheel was adjusted to the center position. There was no steering wheel rim deformation. There was no separation of the steering column's shear capsules.

There was intrusion of the right B-pillar and the right front door panel into the right aspect of the forward compartment. The right B-pillar intrusion measured 20 cm (8 in). The right front door panel intrusion measured 9 cm (3.5 in). The first responders cut the hinges off the front right seat back and separated the seat back from the cushion during the rescue activities. The seat back was found loose within the interior of the ambulance at the time of the SCI inspection.

Manual Restraint Systems

The manual restraints for the driver and front right passenger positions consisted of 3-point lap and shoulder safety belts with buckle pretensioners. The front belt systems consisted of continuous loop webbing, sliding latch plates, and adjustable D-rings. The driver's restraint was equipped with an Emergency Locking Retractor (ELR). The front right restraint was equipped with a switchable ELR/Automatic Locking Retractor (ELR/ALR). Both adjustable D-rings were in the full-up position.

Examination of the driver's restraint revealed that the latch plate exhibited signs of historical use and that the edges of the webbing were frayed from repeated use. The plastic surface of the latch

plate was abraded due to the friction caused by occupant loading at the time of the crash. The D-ring had a metal surface and did not display any physical evidence. The buckle pretensioner was actuated. The driver was restrained by the safety belt at the time of the crash based on the observations of the inspection. This determination was consistent with the imaged EDR data.

Supplemental Restraint Systems

The ambulance was equipped with driver and front right passenger air bags. The Ford E350 was not equipped with automatic suppression for the front right passenger position. Rather, the vehicle was equipped with an OEM On/Off switch to suppress the front right air bag deployment. At the time of the crash, the front right air bag was switched “On.” Both frontal air bags deployed as a result of the crash. The driver air bag module was located in the center of the steering wheel rim. The air bag measured 46 cm (18 in) in diameter and was tethered. There was no occupant contact evidence visible on the face of the air bag.

Patient Compartment

The Type II patient compartment was a 2K model manufactured by AEV of Jefferson, NC. The standard layout of the interior featured a rear-facing attendant’s seat, an inward facing bench seat along the right wall and multiple storage shelving and cabinetry. All cabinets were constructed of 19 mm (3/4 in) plywood, were trimmed with 3 cm (1 in) aluminum, and had sliding plexi-glass doors. The trim was attached to the cabinets with glued wood dowel fasteners. **Figure 10** is a view of the interior taken at the time of the SCI inspection prior to removing any items. The stretcher was loose inside the ambulance floor having been previously removed by the first responders. The ambulance and patient compartment had also been inspected by the NJDOH. Numerous supplies had been displaced from the installed cabinetry by the force of the impacts and debris from the crash site had also been loaded into the interior.

The lateral impact buckled the right double doors inward and buckled the floor vertically (**Figure 11**). The intrusion of the doors measured 15 cm



Figure 10: View of the patient compartment at the time of the SCI inspection.



Figure 11: View depicting the right double door and floor intrusion of the patient compartment.

(6 in) at the elevation of the belt line. The vertical buckling of the floor measured 19 cm (7.5 in). The lateral cabinet/shelf that housed the air conditioner (above the pass-through) fractured due to the compressive load of the impact (**Figure 12**). The vertical cabinet located between the Captain's seat and the driver seat was displaced downward. The right wall aft of the doors, the inward-facing bench seat and the left interior wall/cabinetry was undamaged.



Figure 12: View depicting the fractured cabinet/shelf above the patient compartment pass-through.

The rear-facing Captain's seat was equipped with 3-point lap and shoulder safety belt. The safety belt consisted of continuous loop webbing, a sliding latch plate, a fixed D-ring and a switchable (ELR/ALR) retractor. The webbing was stowed on the retractor at the time of the SCI inspection. Examination of the restraint was unremarkable for crash-related physical evidence. The friction surfaces of the safety belt system were clean and not abraded. The webbing was free of loading evidence. There was minimal evidence of historical use evident on the latch plate. The EMT was not using the restraint at the time of the crash.

A head strike with pocketing was observed on the right wall of the patient compartment immediately above the double doors (**Figures 13 and 14**). This occupant contact was directly to the left of the Captain's seat (was respect to the rear-facing occupant) and was in-line with the direction of the Event 1 impact force. The fracture site measured 33 cm x 33 cm (13 in x 13 in). The EMT's knit hat was found snagged on the fractured wall panel and hair strands were observed within the fracture site. Adjacent to the head strike, at the O2 port, was body matter and a 41cm x 36 cm (16 in x 14 in) area of blood.

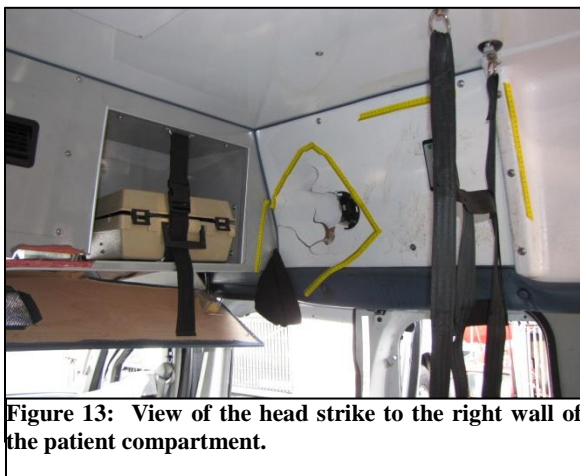


Figure 13: View of the head strike to the right wall of the patient compartment.

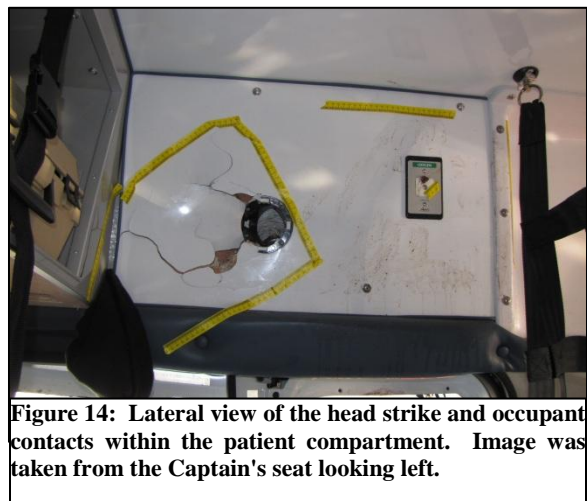


Figure 14: Lateral view of the head strike and occupant contacts within the patient compartment. Image was taken from the Captain's seat looking left.

Patient Stretcher and Fastener System

The patient remained on the stretcher and the stretcher remained engaged with its fastening system throughout the crash sequence. There was no damage to the stretcher or any components of the fastening system.

Figure 15 is a view of the antler bracket mounted to the patient compartment floor and the Stryker Model No: 6371 rail clamp that was mounted to the left wall. There was no deformation of the antler bracket and the stretcher wheels/frame remained engaged with the bracket during the crash. The rail clamp was not deformed and operated properly at the time of the SCI inspection.



Figure 15: View of the patient compartment's antler bracket and floor clamp.

The patient stretcher was a Ferno Model 35A, Serial No: 208915 (**Figure 16**). The stretcher was rated for a 227 kg (500 lb) load capacity.

The X-frame stretcher was manufactured from aluminum tubing and measured 201 cm x 61 cm (79 in x 24 in) in overall dimensions. The frame properly raised and lowered. The locking pin attached to the right longitudinal frame rail was intact and undamaged (**Figure 17**). The back rest was adjustable over a range of approximately 75 degrees via a manual pneumatic shock absorber. The stretcher was equipped with three lateral restraints. Each lateral restraint consisted of adjustable length webbings with a locking latch plate. The fixed ends of the webbing were attached to the side frame of the stretcher. The stretcher was not equipped with a shoulder harness.



Figure 16: View of the Ferno stretcher.



Figure 17: Close-up view of the stretcher's locking pin

2011 FORD OCCUPANTS***Driver Demographics***

Age / Sex: 26 years / Male
 Height: 178 cm (70 in)
 Weight: 82 kg (180 lb)
 Eyewear: None
 Seat Type: Box-mounted bucket
 Seat Track Position: Full-rear track
 Manual Restraint Usage: 3-point lap and shoulder safety belt
 Usage Source: Vehicle inspection, EDR
 Air Bags: Deployed frontal
 Alcohol/Drug Involvement: None
 Egress from Vehicle: Exited vehicle without assistance
 Transport from Scene: Ground ambulance to a local hospital
 Medical Treatment: Treated for minor soft tissue injuries, back and neck pain and held overnight for observation

Driver Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Slightly displaced intra-articular avulsion fracture of the base of the first proximal phalanx (thumb)	752661.1,2	Steering wheel rim	Possible
2	Contusion above the right eyebrow	210402.1,1	Deployed driver air bag	Possible
2	Unspecified neck and back pain	Not codeable	Safety belt	N/A

Source: Emergency Room and Radiology Records

Driver Kinematics

At the time of the crash, the driver was seated in a full-rear track position and was restrained by the 3-point lap and shoulder safety belt. The driver was unaware of the impending crash and did not initiate any avoidance maneuvers.

At impact, the safety belt retractor locked, the buckle pretensioner actuated and the frontal air bags deployed. The driver initiated a right and forward trajectory in response to the lateral direction of force and loaded the safety belt system and deploying driver air bag. His left hand was probably displaced from the steering wheel rim by the deployed driver air bag. During this displacement, the left thumb contacted the steering wheel rim resulting in the fracture. The contact of the driver's face to the deployed air bag was the possible source of the forehead contusion (above his right eyebrow). The unspecified back and neck pain was attributed to the safety belt loading.

The driver remained in contact with the belt system during the long duration crash sequence and rode down the force of the multiple impacts and the rollover. At final rest, the driver was leaning to the right over the belt system toward the front right seat. He was able to release the safety belt and exit the vehicle unassisted through the front left door. He was transported to a hospital and treated for his injuries. He was discharged from the Emergency Room 13 hours post-crash.

Emergency Medical Technician Demographics

Age / Sex:	30 years / Male
Height:	188 cm (74 in)
Weight:	102 kg (225 lb)
Eyewear:	None
Seat Type:	Rear-facing Captain's seat
Seat Track Position:	Forward-most with respect to the vehicle
Manual Restraint Usage:	None
Usage Source:	Vehicle inspection
Air Bags:	Not equipped
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Removed due to perceived serious injury
Transport from Scene:	Ground ambulance to a trauma center
Medical Treatment:	None, deceased upon arrival

EMT Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Blunt force head injury, NFS, ruled fatal	100999.9,0	Right wall of the patient compartment	Certain
2	Blunt force neck injury, NFS	300099.9,0	Right wall of the patient compartment	Certain

Source: Emergency room records. Autopsy Report was not available.

EMT Kinematics

The EMT was seated in a rear-facing mode on the Captain's seat of the patient compartment. He was not utilizing the available safety belt. The EMT was monitoring the patient on the stretcher while the ambulance was en route to the hospital.

The force of the Event 1 impact displaced the unrestrained EMT from the seat. He responded to the lateral direction of the impact force with a right trajectory (with respect to the ambulance). The EMT impacted the right wall with his head as evidenced by the identified fracture. Hair strands were observed embedded within the fracture site and his knit hat was still snagged in the fractured laminate of the wall panel. This impact resulted in the reported blunt force head trauma.

As the EMT's head decelerated at the wall and became fixed, his body mass continued along the lateral path. The mass of the unrestrained body loaded the anatomical structures of the neck resulting in a probable cervical fracture.

The EMT came to rest on the right wall of the overturned ambulance. He was not ejected - contrary to the initial media reports. He was removed from the patient compartment by the first responders and transported by ground ambulance to a trauma center. Resuscitation applied en-route to the trauma center was unsuccessful and he was pronounced deceased 3 minutes after arrival.

Patient Demographics

Age / Sex:	58 years / Female
Height:	163 cm (64 in)
Weight:	100 kg (220 lb)
Eyewear:	None
Seat Type:	Rear-facing stretcher
Seat Track Position:	Not adjustable
Manual Restraint Usage:	Three lateral restraints
Usage Source:	Interview w/ ambulance company
Air Bags:	Not equipped
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Removed from vehicle with assistance
Transport from Scene:	Ground ambulance to a trauma center
Medical Treatment:	Admitted to ICU for pre-existing conditions

Patient Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Small right parietal subdural hemorrhage, 3mm thickness	140651.3,1	Interior loose object	Probable
2	Generalized complaint of pain: neck, chest, abdominal, back	Not codeable	Crash force	Probable

Source: Hospital Records.

Patient Kinematics

The 58-year-old patient was being transported back to the hospital from an off-site dialysis appointment at the time of the crash. The patient was a left lower extremity amputee with a long history of multiple health system complications including: obesity, heart disease, hypertension, diabetes and asthma.

The patient was secured on the stretcher by three lateral restraints in a rear-facing orientation. At impact, the patient initiated a right trajectory in response to the lateral crash force. She likely

contacted the side guard of the stretcher. The patient remained secured on the stretcher throughout the duration of the crash events and subsequent rollover. During the crash sequence, an (unidentified) interior loose object struck the patient resulting in a small subdural hematoma. No soft tissue injury of the head was identified.

She was removed from the patient compartment by the first responders while on the stretcher and transported to a trauma center. She was admitted for evaluation and treatment. The subdural hematoma was identified and monitored by CT scan over the next several days without change. Her condition appeared to be improving. On hospital day six, the patient exhibited an altered mental state and her condition deteriorated over the next two days. The patient died eight days post-crash of her multiple health system complications. Her death was not related to the crash.

2004 CHRYSLER PACIFICA

Description

The 2004 Chrysler Pacifica (**Figure 18**) was identified by the VIN: 2C8GF68424Rxxxxxx with an April 2003 date of manufacture. The all-wheel drive power train consisted of 3.5-liter V6 engine linked to a 4-speed automatic transmission. The Chrysler was equipped with 4-wheel disc brakes with ABS. The digital odometer reading was unknown due to electrical system damage.



Figure 18: Overhead view of the Chrysler.

The manufacturer's recommended tire size was P235/65R17 front and rear, with cold tire pressures of 228 kPa (33 PSI). The left tires were Michelin Energy MXV4 of the recommended size. The right rear tire was Goodyear Integrity and the right front tire was a Continental Contact 4X4. The right tires were also the recommended size. The specific tire data measured at the time of the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	Flat	2 mm (2/32 in)	No	No
LR	Flat	4 mm (5/32 in)	No	No
RR	276 kPa (40 PSI)	6 mm (7/32 in)	No	No
RF	214 kPa (31 PSI)	3 mm (4/32 in)	No	No

Safety features included 3-point lap and shoulder safety belts with retractor pretensioners for the front occupants, multi-stage driver and front right passenger air bags and a left knee bolster air bag.

Exterior Damage

The Chrysler sustained moderate severity damage to its front, left and back planes as a result of this multiple event crash. The direct contact damage to the front and forward aspect of the left plane resembled a deep end-swipe pattern. The damage was separated into the initial front-to-side impact event with the ambulance (Event 1) and a violent side slap of the left plane/forward aspect to the right side of the ambulance (Event 2) as the Chrysler rapidly rotated CW



Figure 19: Front view of the Chrysler.

The front plane sustained direct contact damage across the entire 152 cm (60 in) end width (**Figure 19**). The vehicle-to-vehicle interaction separated the fascia, bumper reinforcement bar and the sub-structures forward of the radiator support plane. [Note, the bumper reinforcement bar was found inside the ambulance and was placed onto the Chrysler for photo documentation purposes.] The front structure of the vehicle was deformed 33 cm (13 in) to the right - measured with respect to the projected original centerline. Residual crush was documented at the deformed left and right frame rail ends and measured 36 cm (14 in) and 46 cm (18 in), respectively. The delta-V of the initial impact calculated by the WinSMASH Damage Algorithm was 43 km/h (27 mph). The longitudinal and lateral components were -33 km/h (-21 mph) and 27 km/h (17 mph), respectively. The results were considered low. The CDC assigned to the Event 1 damage was 71FDEW2. (The 11 o'clock direction of force was incremented to account of the right lateral end shift.)

The left plane/forward aspect damage began at the lower third of the left A-pillar and extended forward 116 cm (45.5 in) to the deformed corner of the upper radiator support. The residual crush profile of the forward left plane measured: C1 = 0, C2 = 4 cm (1.6 in), C3 = 8 cm (3.1 in), C4 = 24 cm (9.5 in), C5 = 46 cm (18.1 in), C6 = 52 cm (20.5 in). The CDC assigned to the side slap damage pattern was 10LYAW3.

The center and aft aspect of the left plane sustained a region of direct contact damage (**Figure 20**) that began on the left roof side rail 86 cm (34 in) forward of the left rear axle. Abrasions were noted to the left ends of the roof racks and related to the black scuff marks observed on the right side of the ambulance. The height of this contact measured 150 cm (59 in) above the ground. The damage pattern extended rearward and

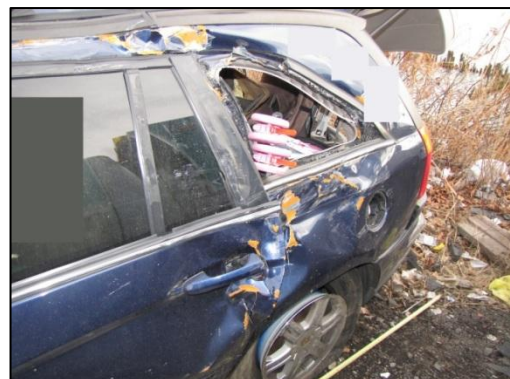


Figure 20: View depicting the damage located at the Chrysler's left plane/aft aspect.

down along the left plane ending 38 cm (15 in) aft of the rear axle reference. This damage related to the non-horizontal impact with the back plane on the ambulance, (Event 4). The CDC was 00LZAW3.

The Chrysler's back plane damage was located at its center and left aspects (**Figure 21**). This damage resulted from the Event 6 impact with the Ford bus. The rear bumper damage was concealed by the fascia which hampered documentation. The direct contact damage began 18 cm (7 in) right of center and ended 51 cm (20 in) left of center. The maximum crush was an estimated 8 cm (3 in). The left gate was crushed forward at its center aspect. The CDC assigned to this damage pattern was 06BYEW2. Examination of the engine compartment revealed that a small engine compartment fire developed (Event 7). Observation and inspection determined that the origin of the fire appeared to be electrical and was subsequently fuel fed. Fire damage was limited to the right engine compartment in the area surrounding the alternator.



Figure 21: Rear view of the Chrysler.

Event Data Recorder

The Chrysler was not equipped with an Event Data Recorder.

Occupant Data

The 29-year-old male driver was restrained at the time of the crash by the 3-point lap and shoulder safety belt. Restraint use was evidenced by the actuated retractor pretensioner and the spooled out webbing consistent with its use. The driver and knee bolster were bags were deployed. The driver sustained unknown injuries, was transported to a hospital via ground ambulance and hospitalized.

2004 WORKHORSE DELIVERY STEP VAN

Description

The 2004 Workhorse Step van (**Figure 22**) was identified by the VIN: 5B4JP42V643xxxxxx. The Workhorse's incomplete commercial chassis' model designation was P42. The vehicle's second stage manufacture was completed with a 5 m (18 ft) Utilmaster Delivery step van body. The rear-wheel drive



Figure 22: Left side view of the Workhorse step van.

power train consisted of a 4.8-liter V-8 engine and an automatic transmission. The wheelbase measured 452 cm (178 in). The overall length of the vehicle measured 787 cm (310 in). The van body consisted of forward sliding doors, a pedestal driver seat, left-mounted driver controls and a pass-through to the 559 cm (220 in) long cargo area. The van body construction consisted of sheet metal body panels riveted to an aluminum framing structure.

Exterior Damage

The left plane of the van exhibited a region of direct contact damage that was located from the B-pillar (trailing edge of the left door) extending 198 cm (78 in) forward to the left fender area above the front axle (**Figure 23**). The lateral extent of the deformation measured approximately 64 cm (25 in). This value did not represent a crush measurement; rather it was representative of the displacement of the side panel and the depth of the maximum vehicle-to-vehicle engagement. The purpose of the body panel was cosmetic and functional; it was not designed for true crashworthiness. The center of the impact region was located at the plane of the instrument panel and engine cowl. The force of the impact displaced the instrument panel 18 cm (7 in) to the right. The steering wheel assembly fractured and separated from the upper aspect of the steering column. The left door separated from its sliding tracks and cantilevered inward into the driver's occupant space. The floor pan buckled vertically in the area of the foot controls. The Truck Deformation Classification was 09LYAW3.



Figure 23: Left side view of the direct damage to the Workhorse.

Occupant Data

The 34-year-old male driver sustained unknown injuries as a result of the impact. His use of the available manual 3-point lap and shoulder safety belt was unknown. Reportedly, he was able to exit the vehicle under his own power. He was transported via ground ambulance to a local hospital.

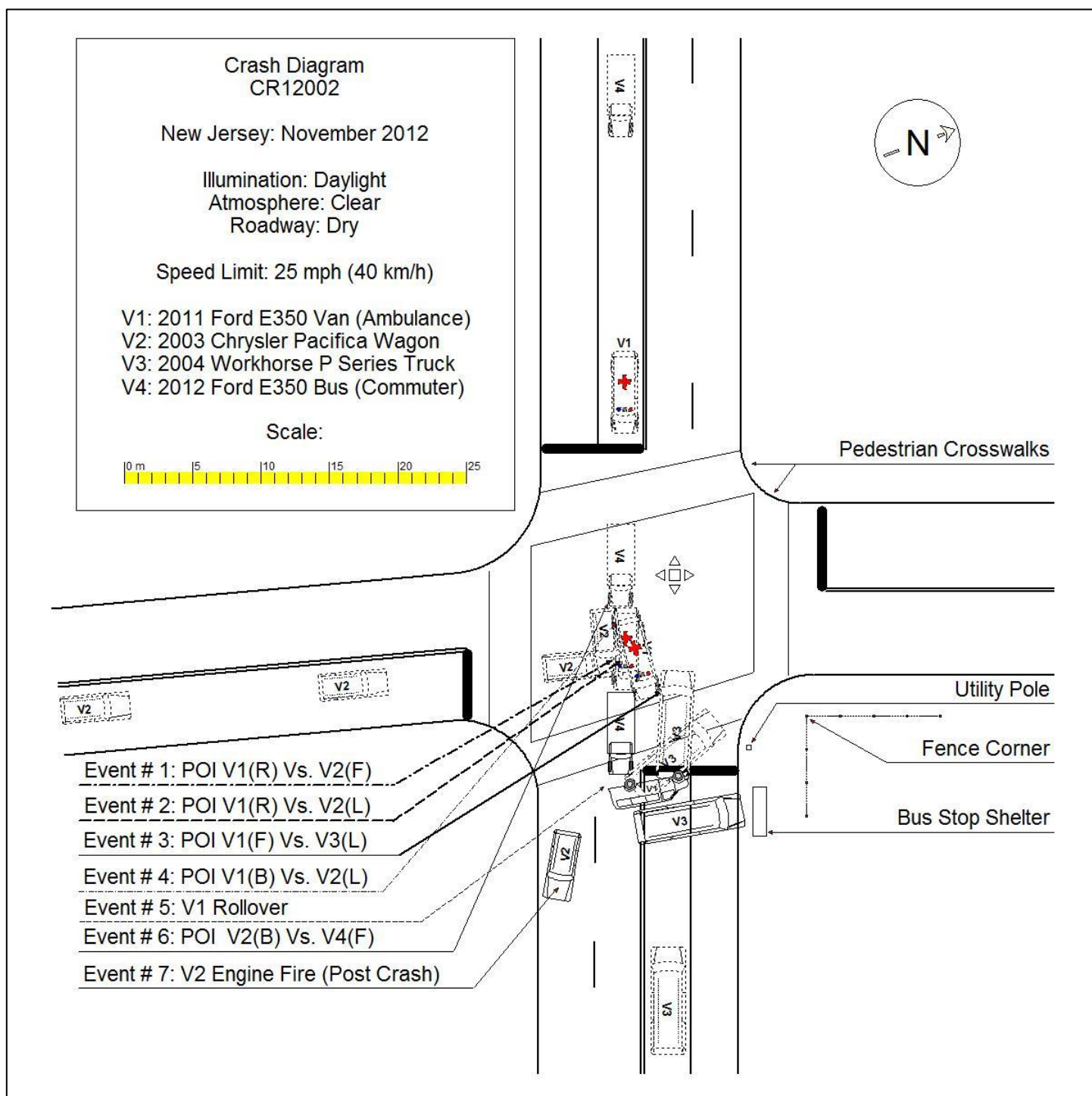
2012 FORD TRANSIT BUS

Description

The 2012 Ford bus was used for public transportation. The vehicle identified by the VIN: 1FDEE3FSXC0xxxxxx. It was manufactured on the E350 cutaway chassis as an incomplete vehicle and then completed by an unknown second stage bus manufacturer. The bus had been returned to the county prior to SCI's involvement in this investigation and was not inspected. The county prosecutor's office reported that the bus sustained damage to right aspect of the frontal plane. The location of this damage was consistent with the impact to the back plane of the Chrysler based on the crash reconstruction.

Occupant Data

The bus driver was a 23-year-old male. He was reported to be restrained by the vehicle's 3-point lap and shoulder safety belt at the time of the crash. He was not injured in the crash and did not seek medical attention. He was the sole occupant of the bus.

CRASH DIAGRAM

ATTACHMENT A

2011 Ford E350 Event Data Recorder Report

IMPORTANT NOTICE: Robert Bosch LLC and the manufacturers whose vehicles are accessible using the CDR System urge end users to use the latest production release of the Crash Data Retrieval system software when viewing, printing or exporting any retrieved data from within the CDR program. Using the latest version of the CDR software is the best way to ensure that retrieved data has been translated using the most current information provided by the manufacturers of the vehicles supported by this product.

CDR File Information

User Entered VIN	1FDSS3ES9BD*****
User	
Case Number	
EDR Data Imaging Date	12/04/2012
Crash Date	
Filename	CR12002_V1_ACM.CDRX
Saved on	Tuesday, December 4 2012 at 13:10:17
Collected with CDR version	Crash Data Retrieval Tool 8.0
Reported with CDR version	Crash Data Retrieval Tool 12.0
EDR Device Type	Airbag Control Module
ACM Adapter Detected During Download	No
Event(s) recovered	locked frontal event rollover event

Comments

No comments entered.

The retrieval of this data has been authorized by the vehicle's owner, or other legal authority such as a court order or search warrant, as indicated by the CDR tool user on Tuesday, December 4 2012 at 13:10:17.

Data Limitations

Restraints Control Module Recorded Crash Events:

Deployment Events cannot be overwritten or cleared from the Restraints Control Module (RCM). Once the RCM has deployed any airbag device, the RCM must be replaced. The data from events which did not qualify as deployable events can be overwritten by subsequent events. The RCM can store up to two deployment events.

Airbag Module Data Limitations:

- Restraints Control Module Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced from the point of algorithm wake up. It is not the speed the vehicle was traveling before the event. Note that the vehicle speed is recorded separately five seconds prior to algorithm wake up. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change.
- Event Recording Complete will indicate if data from the recorded event has been fully written to the RCM memory or if it has been interrupted and not fully written.
- If power to the Airbag Module is lost during a crash event, all or part of the crash record may not be recorded.
- For 2011 Ford Mustangs, the Steering Wheel Angle parameter indicates the change in steering wheel angle from the previously recorded sample value and does not represent the actual steering wheel position.

Airbag Module Data Sources:

- Event recorded data are collected either INTERNALLY or EXTERNALLY to the RCM.
 - INTERNAL DATA is measured, calculated, and stored internally, sensors external to the RCM include the following:
 - > The Driver and Passenger Belt Switch Circuits are wired directly to the RCM.
 - > The Driver's Seat Track Position Switch Circuit is wired directly to the RCM.
 - > The Side Impact Sensors (if equipped) are located on the side of vehicle and are wired directly to the RCM.
 - > The Occupant Classification Sensor is located in the front passenger seat and transmits data directly to the RCM on high-speed CAN bus.
 - > Front Impact Sensors (right and left) are located at the front of vehicle and are wire directly to the RCM.
 - EXTERNAL DATA recorded by the RCM are data collected from the vehicle communication network from various sources such as Powertrain Control Module, Brake Module, etc.

02007_RCM-RC6_r002

System Status at Time of Retrieval

VIN as programmed into RCM at factory	1FDSS3ES9BD*****
Current VIN from PCM	1FDSS3ES9BD*****
Ignition cycle, download (first record)	10,305
Ignition cycle, download (second record)	N/A
Restraints Control Module Part Number	BC24-14B321-AC
Restraints Control Module Serial Number	7110380400000000
Restraints Control Module Software Part Number (Version)	BL84-14C028-AB
Left/Center Frontal Restraints Sensor Serial Number	13ADC6A0
Left Side Restraint Sensor 1 Serial Number	00000000
Left Side Restraint Sensor 2 Serial Number	00000000
Right Frontal Restraints Sensor Serial Number	00000000
Right Side Restraint Sensor 1 Serial Number	00000000
Right Side Restraints Sensor 2 Serial Number	00000000

System Status at Event (First Record)

Recording Status	Locked Record
Complete file recorded (yes,no)	Yes
Multi-event, number of events (1,2)	1
Time from event 1 to 2 (msec)	N/A
Lifetime Operating Timer at event time zero (seconds)	13,016,360
Key-on Timer at event time zero (seconds)	865
Vehicle voltage at time zero (Volts)	14.013
Energy Reserve Mode entered during event (Y/N)	Yes

Faults Present at Start of Event (First Record)

No Faults Recorded

Deployment Data (First Record)

Frontal airbag deployment, time to first stage deployment, driver (msec)	544.5
Pretensioner (buckle) deployment, time to fire, driver (msec)	50.0
Frontal airbag deployment, time to first stage deployment, front passenger (msec)	544.5
Pretensioner (buckle) deployment, time to fire, right front passenger (msec)	50.0
Maximum delta-V, longitudinal (MPH [km/h])	-14.99 [-24.12]
Time, maximum delta-V longitudinal (msec)	300
Maximum delta-V, lateral (MPH [km/h])	-25.95 [-41.77]
Time, maximum delta-V lateral (msec)	71
Left or center front, satellite Sensor discriminating deployment	Yes
Left or center, front satellite Sensor safing	Yes
RCM, front sensor discriminating deployment	Yes
RCM, front sensor safing	Yes
RCM, rollover sensor discriminating deployment	Yes
RCM, vertical sensor safing	Yes
Longitudinal Delta-V Time Zero Offset	5.0 ms
Lateral Delta-V Time Zero Offset	5.0 ms
Roll Angle Time Zero Offset	45.0 ms

Pre-Crash Data -1 sec (First Record)

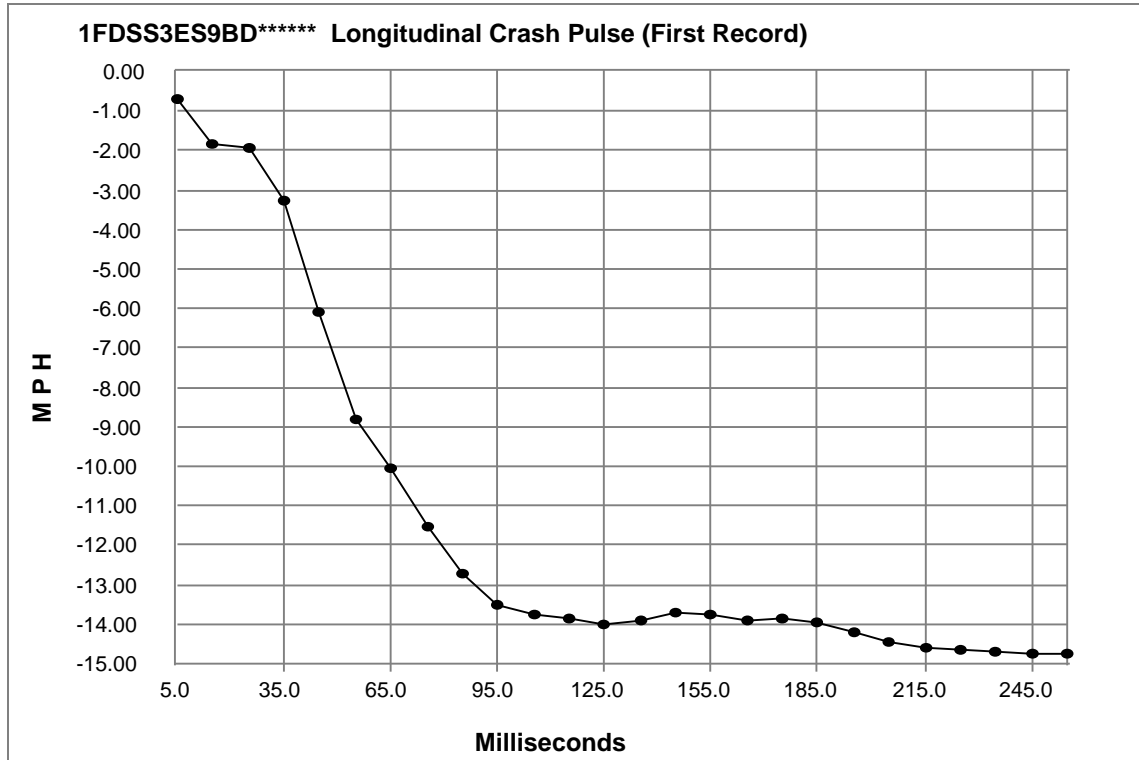
Ignition cycle, crash	10,302
Frontal air bag warning lamp, on/off	Off
Frontal air bag suppression switch status, front passenger	Not Active
Safety belt status, driver	Driver Buckled
Brake Telltale	Off
ABS Telltale	Off
Stability Control Telltale	Off
Speed Control Telltale	Off
Powertrain Wrench Telltale	Off
Powertrain Malfunction Indicator Lamp (MIL) Telltale	Off

Pre-Crash Data -5 to 0 sec [2 samples/sec] (First Record)

Times (sec)	Speed vehicle indicated MPH [km/h]	Accelerator pedal, % full	Service brake, on/off	Engine RPM	ABS activity (engaged, non-engaged)	Stability control (engaged, non-engaged)	Traction Control via Brakes (engaged, non-engaged)	Traction Control via Engine (engaged, non-engaged)
- 5.0	27.3 [44.0]	51	Off	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 4.5	28.6 [46.0]	49	Off	2,200	non-engaged	non-engaged	non-engaged	non-engaged
- 4.0	29.8 [48.0]	31	Off	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 3.5	30.4 [49.0]	40	Off	2,200	non-engaged	non-engaged	non-engaged	non-engaged
- 3.0	31.1 [50.0]	38	Off	2,200	non-engaged	non-engaged	non-engaged	non-engaged
- 2.5	32.3 [52.0]	43	Off	2,300	non-engaged	non-engaged	non-engaged	non-engaged
- 2.0	32.9 [53.0]	46	Off	2,300	non-engaged	non-engaged	non-engaged	non-engaged
- 1.5	34.2 [55.0]	44	Off	2,400	non-engaged	non-engaged	non-engaged	non-engaged
- 1.0	34.8 [56.0]	44	Off	2,400	non-engaged	non-engaged	non-engaged	non-engaged
- 0.5	35.4 [57.0]	29	Off	2,400	non-engaged	non-engaged	non-engaged	non-engaged
0.0	35.4 [57.0]	7	Off	2,100	non-engaged	non-engaged	non-engaged	non-engaged

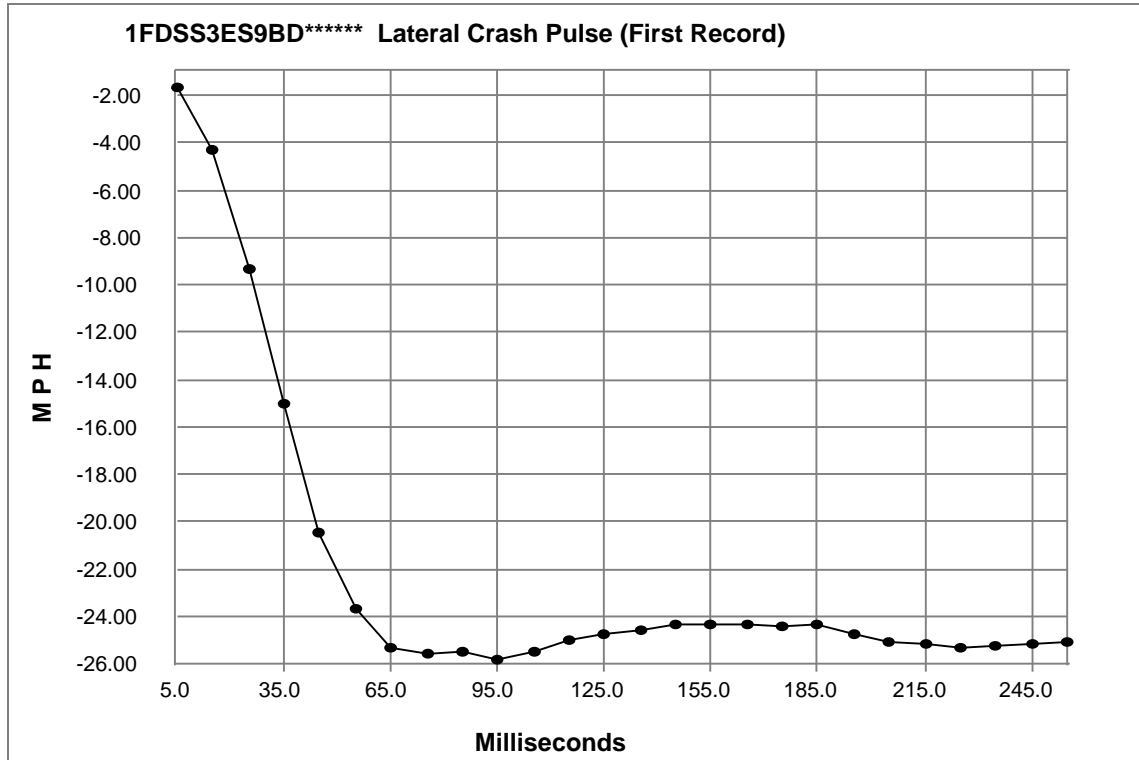
Pre-Crash Data -5 to 0 sec [10 samples/sec] (First Record)

Times (sec)	Steering Wheel Angle (degrees)	Stability Control Lateral Acceleration (g)	Stability Control Longitudinal Acceleration (g)	Stability Control Yaw Rate (deg/sec)	Stability Control Roll Rate (deg/sec)
- 5.0	Invalid	0.103	0.122	1.0	2.25
- 4.9	Invalid	0.122	0.154	0.87	3.87
- 4.8	Invalid	-0.011	0.112	0.37	3.87
- 4.7	Invalid	0.214	0.142	0.87	4.5
- 4.6	Invalid	0.043	0.105	-0.12	3.87
- 4.5	Invalid	0.142	0.112	0.62	2.87
- 4.4	Invalid	0.106	0.05	1.0	-0.62
- 4.3	Invalid	0.252	0.073	0.5	-1.12
- 4.2	Invalid	0.036	0.075	-0.37	-1.0
- 4.1	Invalid	0.104	0.12	-0.12	-1.12
- 4.0	Invalid	0.015	0.089	0.37	-0.62
- 3.9	Invalid	0.106	0.134	0.87	0.87
- 3.8	Invalid	0.095	0.117	0.62	2.75
- 3.7	Invalid	0.068	0.094	0.37	3.75
- 3.6	Invalid	0.075	0.131	-0.37	2.0
- 3.5	Invalid	0.142	0.087	0.37	0.5
- 3.4	Invalid	0.089	0.139	0.12	0.75
- 3.3	Invalid	0.176	0.176	0.0	1.0
- 3.2	Invalid	0.014	0.052	-0.12	-1.0
- 3.1	Invalid	0.095	0.131	-0.75	-1.25
- 3.0	Invalid	0.123	0.131	-1.12	-0.25
- 2.9	Invalid	0.066	0.052	-0.25	0.0
- 2.8	Invalid	0.032	0.073	-0.62	0.87
- 2.7	Invalid	0.124	0.154	0.12	2.12
- 2.6	Invalid	0.042	0.112	0.0	2.25
- 2.5	Invalid	0.096	0.112	0.75	2.12
- 2.4	Invalid	0.082	0.092	0.62	2.87
- 2.3	Invalid	0.118	0.152	0.25	3.25
- 2.2	Invalid	0.065	0.055	0.75	2.0
- 2.1	Invalid	0.133	0.152	0.37	1.0
- 2.0	Invalid	0.116	0.092	0.62	2.25
- 1.9	Invalid	0.226	0.166	0.75	0.25
- 1.8	Invalid	0.068	0.087	0.62	-0.87
- 1.7	Invalid	0.209	0.147	1.0	0.37
- 1.6	Invalid	0.024	0.099	1.0	-1.0
- 1.5	Invalid	0.114	0.171	0.75	-0.37
- 1.4	Invalid	0.211	0.21	1.12	-1.75
- 1.3	Invalid	0.054	0.112	1.37	-1.37
- 1.2	Invalid	0.173	0.152	1.0	0.12
- 1.1	Invalid	0.076	0.092	1.12	0.12
- 1.0	Invalid	0.134	0.112	1.0	0.5
- 0.9	Invalid	0.107	0.131	1.5	2.25
- 0.8	Invalid	0.113	0.075	1.25	1.37
- 0.7	Invalid	0.095	0.07	1.25	0.87
- 0.6	Invalid	0.201	0.112	2.0	0.5
- 0.5	Invalid	0.157	0.073	1.0	-2.87
- 0.4	Invalid	0.063	0.033	1.0	-3.75
- 0.3	Invalid	0.153	0.112	0.0	-2.37
- 0.2	Invalid	-0.015	0.052	0.0	-4.5
- 0.1	Invalid	0.167	0.052	0.0	-4.87
0.0	Invalid	0.037	0.013	-0.75	-3.5



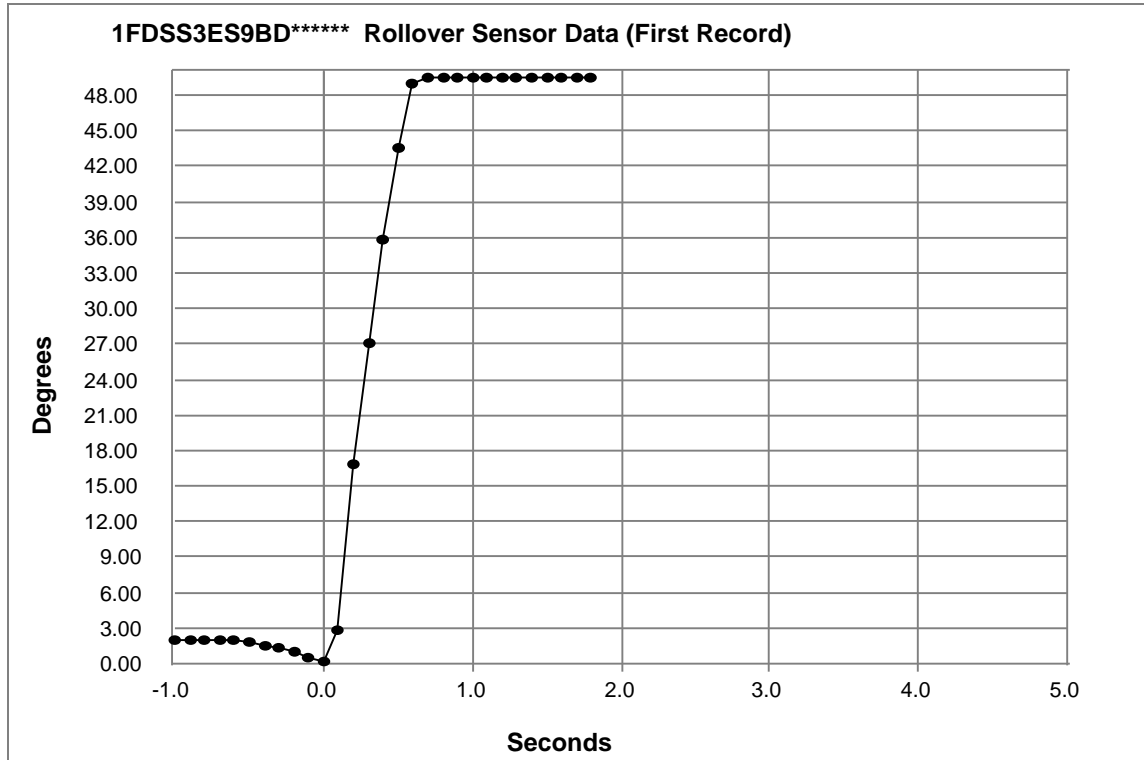
Longitudinal Crash Pulse (First Record)

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
5.0	-0.71	-1.14
15.0	-1.83	-2.94
25.0	-1.93	-3.11
35.0	-3.25	-5.22
45.0	-6.11	-9.84
55.0	-8.81	-14.18
65.0	-10.03	-16.14
75.0	-11.54	-18.58
85.0	-12.72	-20.47
95.0	-13.54	-21.79
105.0	-13.77	-22.17
115.0	-13.85	-22.29
125.0	-14.01	-22.55
135.0	-13.91	-22.39
145.0	-13.72	-22.07
155.0	-13.74	-22.12
165.0	-13.89	-22.35
175.0	-13.88	-22.33
185.0	-13.98	-22.50
195.0	-14.23	-22.90
205.0	-14.46	-23.27
215.0	-14.59	-23.48
225.0	-14.64	-23.56
235.0	-14.72	-23.69
245.0	-14.77	-23.77
255.0	-14.76	-23.75



Lateral Crash Pulse (First Record)

Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
5.0	-1.66	-2.67
15.0	-4.33	-6.96
25.0	-9.32	-15.00
35.0	-15.01	-24.16
45.0	-20.50	-32.99
55.0	-23.69	-38.13
65.0	-25.34	-40.78
75.0	-25.58	-41.16
85.0	-25.55	-41.11
95.0	-25.82	-41.56
105.0	-25.48	-41.00
115.0	-25.03	-40.29
125.0	-24.78	-39.89
135.0	-24.62	-39.63
145.0	-24.36	-39.20
155.0	-24.37	-39.21
165.0	-24.38	-39.23
175.0	-24.40	-39.26
185.0	-24.38	-39.24
195.0	-24.74	-39.82
205.0	-25.12	-40.43
215.0	-25.21	-40.56
225.0	-25.33	-40.76
235.0	-25.25	-40.63
245.0	-25.20	-40.56
255.0	-25.12	-40.43



Rollover Sensor Data (First Record)

Time (sec)	Vehicle roll angle (degrees)
-1.0	1.95
-0.9	1.95
-0.8	1.95
-0.7	1.95
-0.6	1.92
-0.5	1.79
-0.4	1.52
-0.3	1.29
-0.2	0.98
-0.1	0.57
0.0	0.24
0.1	2.83
0.2	16.83
0.3	27.12
0.4	35.78
0.5	43.57
0.6	49.05
0.7	49.59
0.8	49.59
0.9	49.59
1.0	49.59

Time (sec)	Vehicle roll angle (degrees)
1.1	49.59
1.2	49.59
1.3	49.59
1.4	49.59
1.5	49.59
1.6	49.59
1.7	49.59
1.8	49.59
1.9	N/A
2.0	N/A
2.1	N/A
2.2	N/A
2.3	N/A
2.4	N/A
2.5	N/A
2.6	N/A
2.7	N/A
2.8	N/A
2.9	N/A
3.0	N/A
3.1	N/A

Time (sec)	Vehicle roll angle (degrees)
3.2	N/A
3.3	N/A
3.4	N/A
3.5	N/A
3.6	N/A
3.7	N/A
3.8	N/A
3.9	N/A
4.0	N/A
4.1	N/A
4.2	N/A
4.3	N/A
4.4	N/A
4.5	N/A
4.6	N/A
4.7	N/A
4.8	N/A
4.9	N/A
5.0	N/A

Hexadecimal Data

Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR system.

0A 00 00 00

42 43 32 34 2D 31 34 42 33 32 31 2D 41 43 00 00 00 00 00 00 00 00 00 00

37 31 31 30 33 38 30 34 30 30 30 30 30 30 30

42 4C 38 34 2D 31 34 43 30 32 38 2D 41 42 00 00 00 00 00 00 00 00 00 00

13 AD C6 A0 00 00 00 00 00 00 00 00 00 00 00 00

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31 46 44 53 53 33 45 53 39 42 44 2A 2A 2A 2A 2A 2A

31 46 44 53 53 33 45 53 39 42 44 2A 2A 2A 2A 2A 2A 00 00 00 00 00 00 00

Event Record 1

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3E 28 00 00 41 28 00 00 08 B9 27 00 AD 00 00 00 1E 34 00 00 BD A5 FF FF 6F C4 F2
FF 5B 2C 0D 00 33 F3 FF FF 09 3E 0D 00 EA 41 0D 00 4B 42 0D 00 DB 46 0D 00 D2 50
0D 00 34 5A 0D 00 74 5E 0D 00 B7 63 0D 00 CF 67 0D 00 A5 6A 0D 00 79 6B 0D 00 BB
6B 0D 00 4B 6C 0D 00 F2 6B 0D 00 44 6B 0D 00 5D 6B 0D 00 E0 6B 0D 00 D5 6B 0D 00
30 6C 0D 00 0F 6D 0D 00 DA 6D 0D 00 4C 6E 0D 00 79 6E 0D 00 C3 6E 0D 00 EF 6E 0D
00 E3 6E 0D 00 DE CD F2 FF 98 C4 F2 FF 3B B3 F2 FF 6D 9F F2 FF 5C 8C F2 FF 3D 81
F2 FF 83 7B F2 FF B3 7A F2 FF CD 7A F2 FF D7 79 F2 FF 0B 7B F2 FF 96 7C F2 FF 73
7D F2 FF 02 7E F2 FF EF 7E F2 FF E8 7E F2 FF DF 7E F2 FF CB 7E F2 FF DA 7E F2 FF
97 7D F2 FF 49 7C F2 FF FC 7B F2 FF 8E 7B F2 FF D8 7B F2 FF FE 7B F2 FF 46 7C F2
FF E6 12 9F 12 52 12 45 12 45 12 45 12 45 12 45 12 45 12 30 12 CE 11 11 11 6B 10
8B 0F 66 0E 78 0D B7 14 EB 3B BF 58 00 71 CD 86 24 96 A6 97 A6 97 A6 97 A6
97 A6 97 A6 97 A6 97 A6 97 A6 97 A6 97 A6 97 A6 97 A6 97 A6 97 A6 97 A6
68 12 7B 12 7B 12 7B 12 7B 12 78 12 74 12 74 12 74 12 76 12 7F 12 A8 12 DE 12 25
13 46 13 46 13 55 13 55 13 4A 13 32 13 F7 12 FE 7F FE 7F FE 7F FE 7F FE 7F FE 7F
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56 08 45 08 2E 08 53 08 27 08 5B 08 80 08 04 08 53 08 53 08 04 08 19 08 6A 08 40
08 40 08 2C 08 68 08 07 08 68 08 2C 08 76 08 27 08 63 08 33 08 7B 08 A2 08 40 08
68 08 2C 08 40 08 53 08 1B 08 16 08 40 08 19 08 F1 07 40 08 04 08 04 08 DD 07 4A
08 6A 08 C5 07 A6 08 FB 07 5E 08 3A 08 CC 08 F4 07 38 08 DF 07 3A 08 2F 08 14 08
1B 08 5E 08 29 08 80 08 DE 07 2F 08 4B 08 12 08 F0 07 4C 08 FA 07 30 08 22 08 46
08 11 08 55 08 44 08 B2 08 14 08 A1 08 E8 07 42 08 A3 08 06 08 7D 08 1C 08 56 08
3B 08 41 08 2F 08 99 08 6D 08 0F 08 69 08 C1 07 77 08 F5 07 37 08 4A 08 75 46 A7
46 44 46 8E 46 B4 46 82 46 2B 46 44 46 75 46 A7 46 8E 46 75 46 2B 46 75 46 5C 46
50 46 44 46 05 46 E0 45 37 46 12 46 5C 46 50 46 9B 46 8E 46 69 46 9B 46 75 46 8E
46 9B 46 8E 46 B4 46 B4 46 9B 46 C0 46 D9 46 B4 46 C0 46 B4 46 C0 46 CD 46 CD 46
18 47 B4 46 B4 46 50 46 50 46 50 46 05 46 B4 46 A7 46 B3 76 F2 76 B3 76 4F 76 F2
74 C0 74 CC 74 C0 74 F2 74 87 75 43 76 A7 76 F8 75 62 75 7B 75 94 75 CC 74 B3 74
17 75 30 75 87 75 04 76 11 76 04 76 4F 76 75 76 F8 75 94 75 11 76 49 75 D9 74 55
75 CC 74 0B 75 81 74 A7 74 3C 75 3C 75 62 75 11 76 B9 75 87 75 62 75 11 74 B9 73
43 74 6E 73 49 73 D2 73 11 76 B3 76 41 04 41 04 64 00 64 00 00 00 00 00 00 00
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00 3C 14 00 00 1D 39 18 00 3C 12 00 00 07 39 15 00 3C 0B 00 00 33 2C 15 00 3C 15
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40 DB 00 00 00 00 50 40 D5 00 00 00 00 00 00 4A 40 AA 00 00 00 00 3E 40 45 00
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